FOREWORD

Aquaculture is an important part of the Common Fisheries Policy. Indeed, the Community incentives policy for the farming of sea or fresh water fish, shellfish and molluscs must contribute to supplying the Common Market with fisheries products and to reducing the chronic negative trade balance in this area.

The collection of statistics on the economic and social aspects of Aquaculture in the European Community is not a straightforward process.

Furthermore, an exact definition of aquaculture which distinguishes it clearly from fisheries is not easy to find.

Indeed, given the similarities that exist between both types of activity, it is easy to confuse them. The Commission would therefore suggest the following definition of Aquaculture as being acceptable, albeit imperfect :

"Aquaculture is the farming of sea or freshwater organisms. It involves the implementation of farming techniques (regular stocking, feeding, protection from predators) whose purpose is to increase, beyond the natural productive capacity of the environment, the production of fish, shellfish, molluscs and plantlife which remain the property of the farmer during the rearing period."

"Aquaculture products are aquatic organisms harvested by a natural or legal person having had them in his ownership during the rearing period."

The document given to you under the title AQUACULTURE IN THE EUROPEAN COMMUNITY sets out to sum up the situation as regards the different sources of statistics available and is in line with the above definition of Aquaculture.

It has been prepared by the Commission of the European Communities in such a way as to make it as reliable as possible and is accompanied by a MAP OF EUROPEAN AQUACULTURE specially produced by the Commission for EURAQUA 92 seminar, which is devoted to Community Policy in favour of developments in this sector.

The document represents a concrete attempt to visualize European Aquaculture. It is not perfect but it can be improved on gradually as the data become available.

I hope that it forms, for professional circles and for the general public, a source of supplementary information as well as a contribution to involving Aquaculture more fully in the completion of the Single Market and in European integration.

J. ALMEIDA SERRA

DIRECTOR GENERAL FOR FISHERIES
COMMISSION OF THE EUROPEAN COMMUNITIES

EURAQUA '92

INTRODUCTION

I. AN OVERALL PERSPECTIVE ON AQUACULTURE

The essential purpose of aquaculture is the aquatic production of proteins from animal or plant life that are directly edible by man.

There are also types of aquaculture that produce ornamental species (carp, red fish) but this field of activity is relatively marginal in economic terms.

1. Aquaculture production

The food output coming directly from aquaculture in global terms today represents some 14 million tonnes and valued at 22 billion US dollars*.

World aquaculture is dominated by Asia which accounts for 80 % of production due notably to carp and seaweed farming.

The EEC produced around 925 000 tonnes of fish, shellfish and molluscs through aquaculture in 1989. This production represents 1,4 billion ecus (approximately 1,6 billion US dollars)**.

2. European policy

▲ *There is an important demand for high standard products on the european fish market. (Photo Serge Lucas).*

The principle characteristic of european aquaculture is a sustained demand for high quality fish because the supply of fish from seafishing is unsufficient; this is due to the restrictive European policies, limiting access to the resources which are already overfished.

A common Fisheries Policy, has been adopted by the Council of the European Communities and the Commission, for the fisheries and aquatic farming sectors, of which the "aquaculture" section provides for the allocation of national public and Community aid to the development of this sector (regulation EEC No 4028/86 of 26 December 1986).

European aquaculture is also a coastal and rural activity which could be of particular value in the context of Regional Programmes in certain areas of the Community by creating employment in these regions.

▲ *Aquaculture also has a planning function to develop areas like ponds, lagoons, marshes. (Photo A. Piccioli).*

By participing in the planning of economic development of certain european regions, aquaculture could contribute to the harmonious development of a single European market.

As in the case of agricultural solutions to the problem of population drain in the countryside (set aside) one can also see, the conversion of certain sites to "aquaculture" as a solution rehabilitating certain marshes, swamps, ponds and lagoons.

3. Aquaculture assessment

There are in fact several types of fish farming where the protein value varies according to how one views the situation, and the position of the organism being reared, in the food chain.

For example seaweed production, which feeds directly from light energy due to photosynthesis, represents an inexpensive type of food production in regions where it is readily accepted (China, Japan).

▲ *Extensive rearing is generally in balance with the environment and is relatively pollution free. (Photo Serge Lucas).*

Carp farming can be equally straightforward as in chinese style rural rearing systems where the family pond is supplied with animal based fertilisers to feed the plants which in turn are consumed by the fish.

Extensive farming, where the farmer organizes his production so that the productivity of the natural environment is sufficient to assure growth under economically acceptable conditions, is in balance with the environment and is relatively pollution free.

Shellfish culture, and other forms of fish farming where the "inputs" are minimal can be included in this type of aquaculture.

(*) F.A.O. data, 1988.

(**) The exchange rate for the ecu on the 31st December 1989 is 1.143 US dollars.

On the other hand, new methods of fishfarming such as salmoniculture, farming of seabass and seabream, turbot and other farmed species in an open or confined environment where feeding accounts for up to 60 % of production costs, are intensive methods of farming.

▲ *Intensive rearing, where feeding can represent up to 60 % of the production costs, can have important effects on the environment. (Photo Serge Lucas).*

Intensive aquaculture can have an important impact on the environment where effluents may not be reprocessed and treated, as in the case of intensive aquaculture in an open environment. In this event standards must be adopted in relation to the density of rearing.

Also, fishmeal is an important component of production costs for aquaculture and it must be of high quality.

This type of farming especially when it's intended for carnivorous species, requires 8 kg of "fodder" fish of low commercial value to be caught in order to rear 1 kg. It is the same as "sériole" farming in Japan. Resorting to compound feed allows a reduction of this requirement from 8 kg to 5 kg, the difference being made up by other components.

This form of aquaculture is obviously only suitable for markets in which there is a significant demand for high value species. Such demand exists for salmonids, turbot, seabass and seabream. It is a typical form in rich countries and this type of aquaculture does not justify research to find a solution for global nutritional problems. Only direct use of sunlight for species at the beginning of the food chain can achieve this end.

On the other hand, transforming proteins from "fodder" fish into "noble" proteins can justify this type of aquaculture in an ecosystem where a certain number of marine stocks are underfished.

In this instance, aquaculture appears to compete with pig and chicken breeding which also uses fish meal as a high quality food component.

Furthermore, we are seeing at present the direct transformation of species of low commercial value thanks to modern processing methods, into quality gastronomical products. This has happened with crab sticks or prawn "ersatz", the consumption of which has become popular in Europe and is something which the Japanese have known for a very longtime (Surimi and Kamaboko).

The aquatic or land farming markets and those of Kamaboko are in competition as they transform a protein of low commercial value into a higher value product.

II. THE DOCUMENT

The objective of the present document, titled AQUACULTURE IN THE EUROPEAN COMMUNITY aims to give a global description of aquaculture activity at a European level.

This document provides different species sheets which permit analysis and comparison of the different systems found in the European Community.

Each one of these sheets is subdivided into four sections :

1. Biological elements and natural conditions

This analysis permits an identification of biological characteristics as well as the geographical distribution of species analysed.

2. Farming techniques

This involves a description of the process and of the farming methodology of the species in question.

3. The importance of the species in the EEC

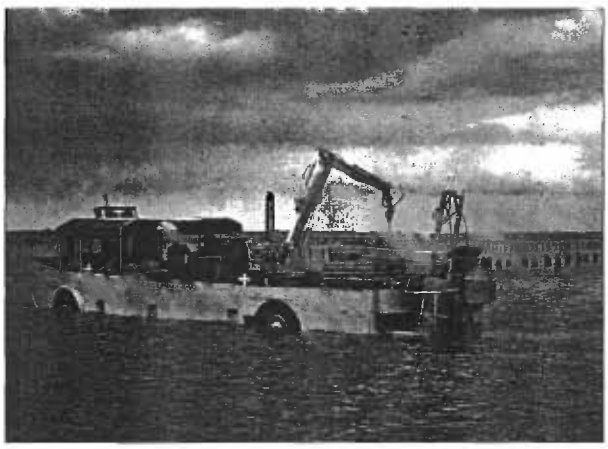
This section follows closely the relative importance of the production for each species in terms of volume and value.

Various statistical sources have been used in this document and particularly

– European Association of Fisheries Economists, report prepared for the Commission (September 1990);
– Reports of general meetings of the "Fédération Européenne de la Salmoniculture", FES-1990;
– EUROSTAT and FAO reports about world agricultural production.

These datas were then submitted to the administrations of the Member States in order to establish their opinions.

4. The development perspectives will be defined on the basis of previous and present evolutionary conditions of the species studied.



▲ *Barge going on seabeds at low tide. (Photo Section Rég. Conchylicole de Bretagne).*

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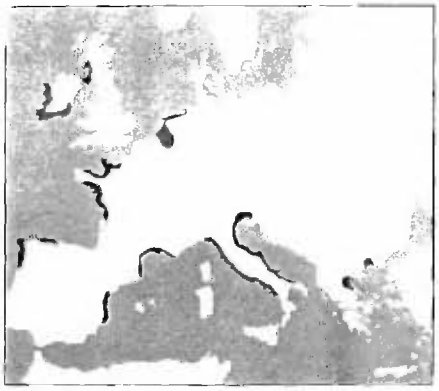


Main mussel farming areas in the EEC.

MUSSEL CULTURE

MUSSELS

Mytilus edulis Linnaeus
Mytilus galloprovincialis Lamarck

English	:	Mussels	German	:	Muscheln
French	:	Moules	Greek	:	Mýdia
Dutch	:	Mosselen	Spanish	:	Mejillónes
Danish	:	Blåmuslinger	Portuguese	:	Mexilhaoes
Italian	:	Mitili			

1. Mussel biology and ecology

The mussel is a bivalve shellfish from the *Mytilus* genus. It is widely distributed around the world, from tropical to polar regions.

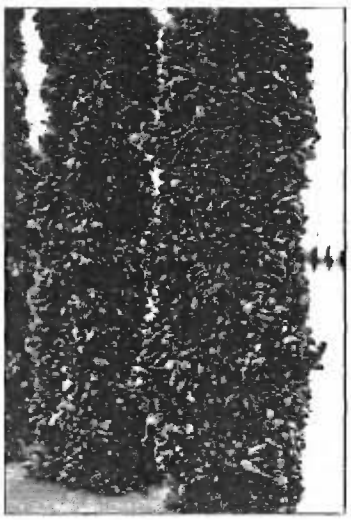
Two species are cultivated in Europe.

— *Mytilus galloprovincialis* (Atlantic Ocean, Mediterranean Sea).

— *Mytilus edulis* (Atlantic Ocean, North and Baltic Seas).

After a free-swimming larval stage, the young mussel settles down, thanks to its byssus, in the intertidal range to a depth of 20 m.

During its sedentary life, it feeds on microparticles by filtering seawater through its gills.



Close-up of growing mussels on "bouchots" - Brittany, France (Photo Section Rég. Conchyl). ►

2. Cultivation techniques

Up until the XIXth century, the only known technique to grow mussels was the upright wooden sole or "bouchots" - technique, invented in France during the XIIIth century. The suspended rope culture then appeared in Spain in 1846; finally a third technique called "bottom culture" first appeared in the 1860's in the Netherlands.

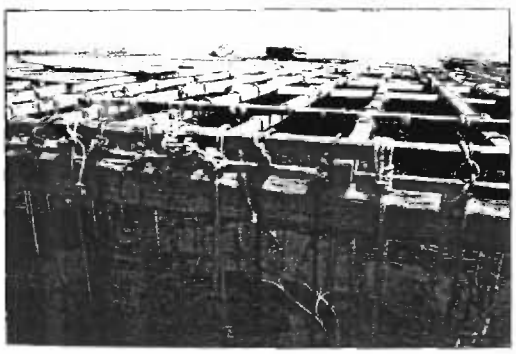
2.1. Bouchot culture : A bouchot is made of a series of heavy wooden poles dug upright into the sea bottom. Mussel seeds collected around March either on poles which are further out to sea or along hairy ropes, are transplanted onto growing poles ("boudinage") in July. Harvesting occurs after 15 months of growing and is repeated periodically with a special tool mounted on a hydraulic crane known as a "pêcheuse".

2.2. Suspended rope culture : For this technique, ropes covered with mussel seeds are suspended either from metallic frames or from floating structures, so that the young mussels stay under water at all times. Each frame is built of metallic poles dug upright into the ground, at depth varying between 3 and 9 meters. Young mussels placed in nylon nets are grown in this way the whole year round and according to demand. Floating structures are either rafts("bateas"), floating saucers or floating longlines.

2.3. Bottom culture : This technique rests upon the harvesting of naturally produced young mussels and their spreading out on specially prepared growing plots. It is widely practiced in the Netherlands.

▲ *Rows of ropes covered with mussel spats before being wrapped around "bouchots" (in the background) Brittany, France (Photo Section Rég. Conchyl).*

Close-up of a raft (bateas) carrying lines of mussels in Galicia (Photo A Piccioli). ▼

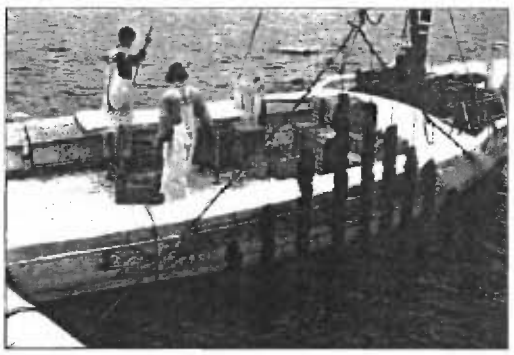


Shellfish culture service boat leaving the seabeds during the rising tide in Brittany, France (Section Rég. Conchyl.). ►

3. Mussels culture within EEC

EC production of mussel amounted to 522.000 mt in 1989 which represents about 50 % of its world production. This represents a value of 294 mecus, of wich Spanish production amounting to 300.000 mt represented about a third.

Most of this production is grown on suspended ropes, a technique which can be extended further offshore. Although sensitive to planktonic blooms, it is the only technique which could still lead to a production increase, since both the "bouchot" and the bottom techniques are faced with growing coastal pollution, bird predation and land use constraints.



▲ *Service boat rising a mussel longline in the Gulf of Trieste, Italy (Photo A. Piccioli).*

▲ *Service boat and longlines used in the Gulf of Trieste, Italy. (Photo A. Piccioli).*

Mussel production : volume and value per EC country in 1989.

Country	Volume	Values
Spain	240 000 t	110,00 mecus
Netherlands	107 000 t	43,00 mecus
Italy	100 000 t	71,70 mecus
France	53 000 t	55,00 mecus
Ireland	15 300 t	8,90 mecus
United Kingdom	4 900 t	3,70 mecus
Greece	1 900 t	1,82 mecus
Total	522 100 t	294,12 mecus

4. Development perspectives

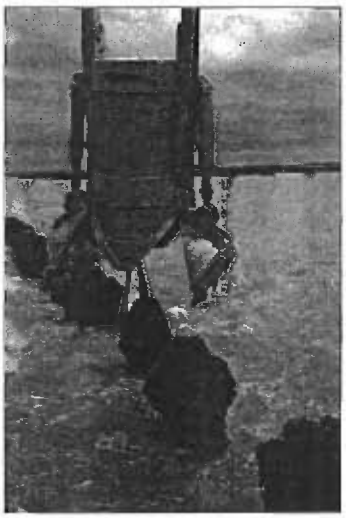
The mussel market is doing quite well lately, especially when compared to the oyster market : in late 1990 for the first time ever in France, mussel prices were higher than oyster prices !

Demand is stable and supplies seem to be under control thanks to the Spanish administration's ability to limit further expansion of raft production (Galicia).

Within other EC regions, mussel production has been developed recently on ropes suspended from longlines (Southern France and Italy) or from rafts (United-Kingdom and Ireland) since hanging culture avoids a number or those environmental problems linked to the use of the intertidal range. However, environmental concerns will remain a major constraint for mussel cultivation.

The new EC directive regarding shellfish sanitary norms will lead to an improvement of mussel processing conditions, thus to a better marketing position for the mussel which has not always been perceived as safe.

▲ *Hydraulic arm used in Galicia for raising mussels lines. (Photo A. Piccioli).*



▲ *Harvesting crane ("Pêcheuse") working on a mussel bed in Cancale bay, Brittany, France (Photo Section Rég. Conchyl).*

Edited by the Commission of the European Communities - Directorate General for Fisheries.

Main oyster farming areas in the EEC.

OYSTER CULTURE

OYSTERS

Ostrea edulis Linnaeus		*Crassostrea gigas* (Thunberg)	
English	: European flat oyster	English	: Pacific oyster
French	: Huître plate	French	: Huître creuse
Dutch	: Oester	Dutch	: Portugese oester
Danish	: Østers	Danish	: Stillehavsøsters
Italian	: Ostrica	Italian	: Ostrica portoghese
German	: Europäische Auster	German	: Japanische Auster
Greek	: Strídi	Greek	: Strídi
Spanish	: Ostra	Spanish	: Ostra japonesa
Portuguese	: Ostra redonda	Portuguese	: Ostra do Pacífico

1. Oyster biology and ecology

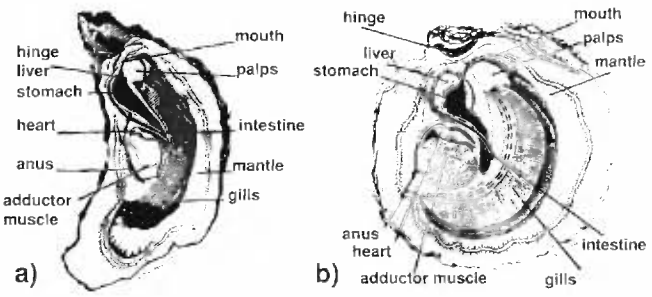
Oyster is a bivalve shellfish. Two genera are cultivated in Europe but mostly in France :

— The *Crassostrea* genus includes the portuguese oyster and the japanese oyster which comes from the Pacific Ocean, both belonging to the *Crassostrea gigas* species.

— The *Ostrea* genus is represented by the flat oyster which is found from Marocco to Norway and in the Mediterranean Sea.

The larvae are free swimming until they settle down and turn into young oysters growing on a bed below the low tide mark (*O. edulis*) or within the intertidal range (*C. gigas*).

The oyster feeds on dissolved substances and micro-particles which it filtrates through its gills. An inflow of freshwater improves its growth rate.



▲ *Anatomic diagram of both species of oysters cultivated in the European Community : a) Crassostrea gigas (Japanese oyster) b) Ostrea edulis (flat oyster).*

2. Cultivation techniques

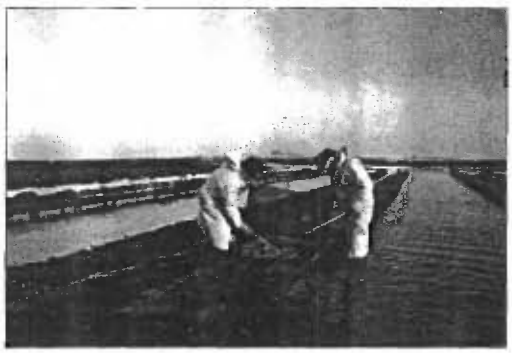
Plinius the Old reported that the Romans knew how to collect oyster spat on wood faggots. Oyster culture developed in France during the XVIIth century, however, it was not until the mid XIXth century that modern oyster culture appeared, using such a technique as chalk covered tile collectors and relying upon state allocation of growing plots in the intertidal range.

Nowadays, European growing techniques are geared towards a market for fresh delivered in their shells.

Cultivation thus begins with the collection of small oysters on a support from which they can be removed easily ("détrocage") six to eight months later. During their second year oysters are spread in the intertidal range :

— either directly on the ground (bottom culture),
— or in bags on trestles,
— or suspended (Mediterranean shores).

Harvesting takes place during the third year usually.

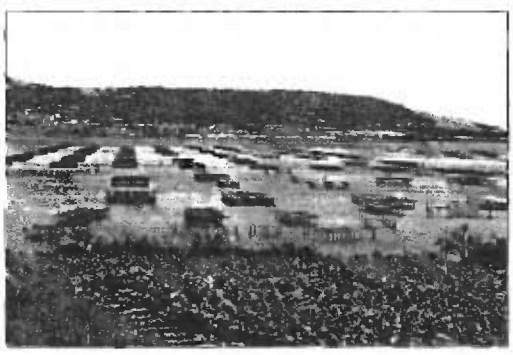


▲ *Working on oysters in bags on trestles located in the intertidal range – St. Vast la Hougue, France. (Photo Serge Lucas.)*

▼ *Example of oysters cultivation directly on the ground (bottom culture) in Brittany, France. (Photo Serge Lucas.)*

A special treatment known as "affinage" may be carried out for top quality oysters which are brought into former salt marshes turned into pounds. By feeding on a blue algea growing there (navicule) the oyster turns into a "fine de claire" or a "special" characterized by a green colour.

General view of trestles at Thau pond, France. (Photo Serge Lucas.) ▶

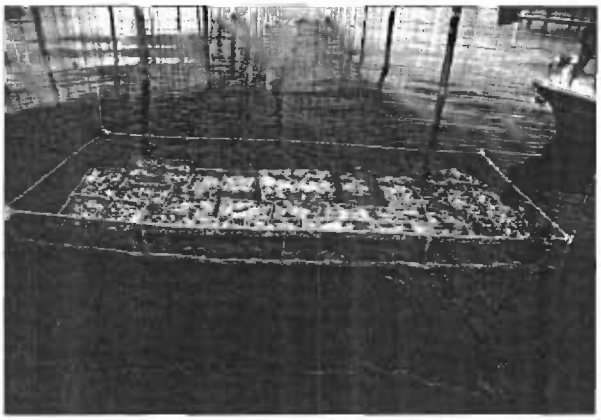


3. Oyster culture within EEC

EC production of oysters amounted to 137,000 tonnes in 1989, which represents about 13,5 % of world production, howewer, France accounts for some 96 % of EC production. Actually, most oyster culture is concentrated between Caen and Arcachon, an area within which about 80,000 mt of *Crassostrea* are grown.

This concentration suggests that the density of growing plots could account for the parasitosis and viral outbreaks which have repeatedly plagued oyster culture for, decades : the portuguese oyster was wiped out after an epidemic of gill disease in 1965, the flat oyster suffered an outbreak of *Martelia* then of *Bonamia* in 1968 and the japanese oyster was successively infested by an iridiovirus in 1977 and *Mytilicola*.

Harvesting the oysters in bags. These oysters of commercial size are ready for "affinage" – La Tremblade, France. (Photo Serge Lucas.) ►



▲ *Immersion of oysters ready for marketing – Bouzigues, Thau pond, France. (Photo Serge Lucas.)*

Volume and value of oyster production per EC country in 1989

Country	Volume	Value
France	130 500 t	162,4 mécus
Spain	3 300 t	11,2 mécus
Netherlands	1 800 t	7,1 mécus
Ireland	860 t	2,0 mécus
United-Kingdom	137 t	0,4 mécus
Germany	50 t	0,3 mécus
Total	136 647 t	183,4 mécus

▲ *Shipment workshop in France. (Photo Serge Lucas.)*

4. Prospects for future development.

Following a series of disease outbreaks which ruined production areas, French oyster growers are now faced with serious marketing problems.

By the end of 1990 for the first time in France oyster prices were barely higher than those of mussels ! This price collapse is likely to discourage other EC countries, like Ireland, United-Kingdom or Germany which are trying to promote this culture. Its consequences are likely to be dramatic for a sector comprised of small enterprises with reduced financial capacities.

There is a clear need for growing areas to be reorganized so as to adapt densities to carrying capacities and to avoid catastrophic disease outbreaks. This necessity and that of adapting thousands of small-scale oyster farms to sanitary standards are likely to lead, in the medium term, to a concentration of production means.

Edited by the Commission of the European Communities – Directorate General for Fisheries.

Main salmon farming areas in the EEC.

SALMON

ATLANTIC SALMON

Salmo salar Linnaeus

English	:	Atlantic salmon	German	:	Atlantischer Lachs
French	:	Saumon de l'Atlantique	Greek	:	Solomós toú Atlantikoú
Dutch	:	Atlantische zalm	Spanish	:	Salmón del Atlántico
Danish	:	Laks	Portuguese	:	Salmão do Atlântico
Italian	:	Salmone atlantico			

1. Natural conditions

Salmon is a species indigenous to the northern hemisphere (Pacific and Atlantic oceans).

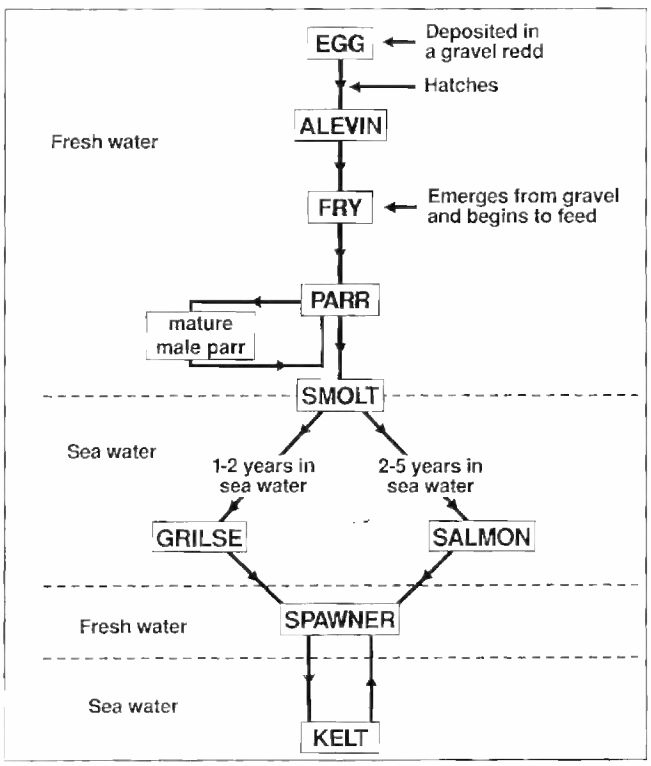
Most of the production originates from the wild catch of Pacific salmon *Oncorhynchus spp.* which is commercialized as an inexpensive canned or frozen product. However, the Atlantic salmon *Salmo salar* is one of the rare species, and therefore a high value product. Farming of Atlantic salmon begun in the 1960's in Norway, and has now been developed successfully in Scotland (United Kingdom), Ireland, Faeroes, Chili, North America and Australia.

In the natural life cycle this anadromous species sheds eggs in freshwater, later grows and matures in saltwater while returning to their parent rivers to complete the spawning and procreation stages.

This anadromous habit divides the farming of salmon into two stages, fresh-and saltwater, for which clean and well oxygenated temperate water is required. After a period of 3-4 years, the whole life cycle of the salmon can be reproduced in captivity using intensive farming systems.

▲ *Returning salmon struggling against the river's current to reach upstream spawning grounds (Photo J. Wessel).*

▼ *Atlantic salmon's life cycle ("Salmon and Trout Farming"; LAIRD L.M. and NEEDHAM T.)*



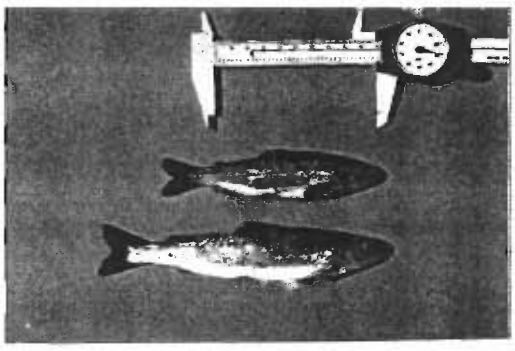
2. Farming cycle

2.1. Freshwater stage

The production process for farmed salmon begins in autumn when the broodstock is stripped.

The eggs hatch into fry at early spring. Different types of tank or cages are used to grow the fry to parr and then to smolt.

Smolting occurs normally only once a year, in spring, at an age of about 17 months, and prepares the fish to be transfered into the sea. Different methods of manipulating the light and/or temperature regimes have been developed in order to ensure a year round supply of smolts for the ongrowing of salmon in seawater.



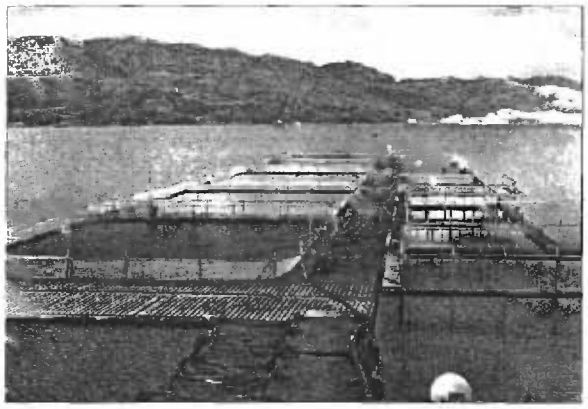
From the various complex changes occuring during the smoltification process, the silvering of the body differenciate the smolt (lower) from the parr (upper) (Photo J. Wessel). ▶

2.2. Seawater stage

Commercial size of 2-5 kg salmon is obtained in a period of 1-2 years in floating net cages in the sea in well protected areas. Environmental set-backs and scarcity of protected sites has led to the development of offshore cages and, of less importance, land based sites using pumped seawater systems.

3. Salmon farming in the EEC

In volume terms and after trout, salmon is the second major finfish farmed, dominated by Scotland (United-Kingdom), and Ireland which both amount for around 17 % of the total world's farmed salmon production (Atlantic and Pacific salmon). These two countries account for approximately 82 % and 15 % of the 34 600 t produced in 1989, respectively. Small but growing quantities are produced in Spain and France.



▲ *Modular cage system for the ongrowing of salmon in seawater (Photo J. Wessel).*

▲ *Harvesting of marketable salmon by cutting the gill, the fish is bleeded (Photo J. Wessel).*

Production has grown rapidly throughout the 1980's, from only 1 000 t in 1981 to 34 600 t in 1989, with a turnover of around 183 mecus.

Production of salmon in 1989

Country	Volume	Value
United-Kingdom	28 500 t	155,70 mecus
Ireland	5 800 t	25,80 mecus
Spain	150 t	0,81 mecus
France	150 t	0,78 mecus
Total	34 600 t	183,09 mecus

The bulk of the production is marketed inside the EEC mainly smoked and fresh, while the remaining part is exported.

4. Prospects for future development

The internationally traded salmon faces an intensively competitive market. The exponential increase in production has led to substantial decreases in prices during 1989 and 1990.

Hence, efforts are needed to develop additional processing into new value added products.

Environmental constraints and scarcity of well protected sites have led to the development of offshore and land based rearing techniques, which will become of greater importance as these constraints increase.

▲ *Offshore cages technology have been developed in order to use exposed sites for the ongrowing of salmon (Photo Irish Salmon Growers' Association).*

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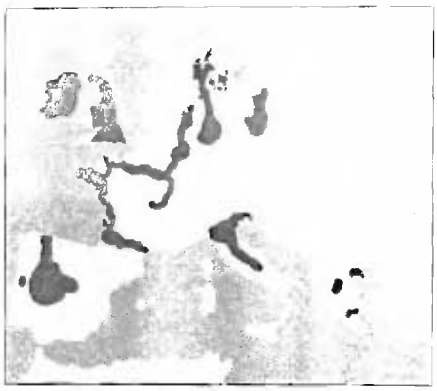


Main trout rearing in the EEC.

TROUT

RAINBOW TROUT

Oncorhynchus mykiss Walbaum

English	:	Rainbow trout	German	:	Regenbogenforelle
French	:	Truite arc-en-ciel	Greek	:	Péstropha iridízusa
Dutch	:	Regenboogforel	Spanish	:	Trucha arco iris
Danish	:	Regnbueorred	Portuguese	:	Truta arco-iris
Italian	:	Trota iridea			

1. Natural conditions

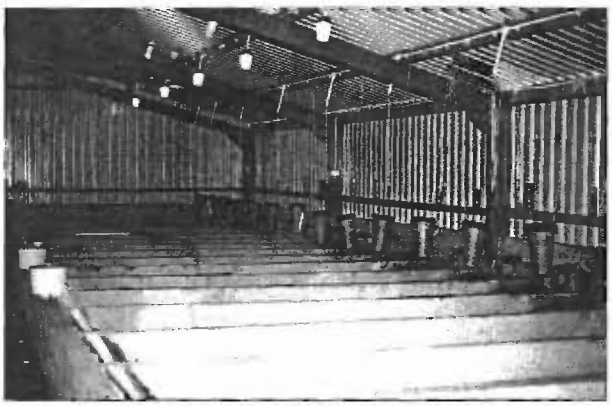
Trout is the major finfish cultured in Europe with a long lasting tradition in several countries.

Trout farming has been developed in a wide range of latitudes throughout the world.

The main species rainbow trout *Oncorhynchus mykiss* is farmed mainly in freshwater to portion size (up to 300 g). After the freshwater stage, this anadromous salmonid species is also grown in seawater to bigger size (1-2 kg). For both fresh and seawater culture, well oxygenated temperate water is required.

Other freshwater salmonid species farmed in the EEC, mainly for restocking purposes, are the brown trout *Salmo trutta* approximately 3.500 MT/year and the brook trout *Salvelinus fontinalis*, approximately 1.250 MT/year.

▲ *Farming of rainbow trout (Photo Serge Lucas).*



▲ *Hatchery with concrete raceways for the rearing of juveniles (Photo J. Wessel).*

2. Farming cycle

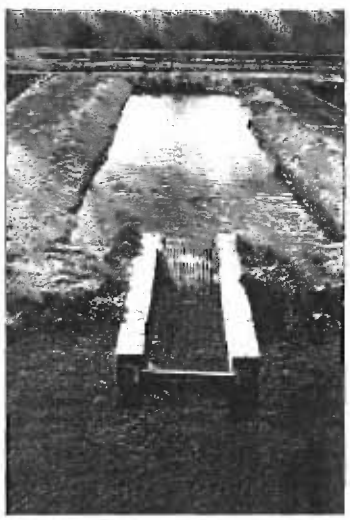
A variety of farming systems are used throughout Europe and within countries.

Land based systems are the most popular, using tanks, raceways and ponds, but also ongrowing in cages in fresh and seawater is practised.

Artificial reproduction is a well known and widely utilised technique. After a period of approximately 8 months from birth first marketable fish of 250-300 g is obtained. To ensure an overall year supply of marketable fish, different methods of manipulating light and/or temperature regimes have been developed.

At an age of around 14 months maturing males appear. Maturation hinders growth and decreases overall growth rate. To avoid this problem different technique of sex reversal to obtain all female stocks and triploid fish are being used.

Hand feeding in a raceway system for the ongrowing of trout (Photo Serge Lucas). ►



Danish earth pond system for the ongrowing of trout (Photo J. Wessel). ►

3. Trout farming in the EEC

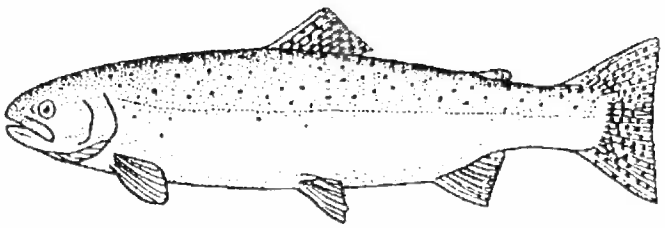
Intensive farming of trout is a well established industry in Europe, Danemark, France, Italy and Germany being the major producers.

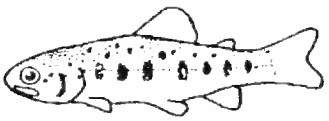
Trout production in EEC Member States in 1989.

Country	Volume	Value
France	35 850 t	87,90 mecus
Danemark	31 700 t	83,70 mecus
Italy	31 000 t	76,90 mecus
Germany(*)	25 590 t	80,81 mecus
Spain	16 000 t	37,15 mecus
United Kingdom	15 000 t	45,23 mecus
Greece	2 000 t	4,91 mecus
Ireland	1 200 t	3,60 mecus
Portugal	1 200 t	2,65 mecus
Belgium	800 t	2,00 mecus
Netherlands	220 t	0,58 mecus
Total	160 560 t	425,43 mecus

(*) Note : Production of GDR is included.

▲ *Cages in seawater for the ongrowing of rainbow trout to bigger sizes (Photo J. Wessel).*

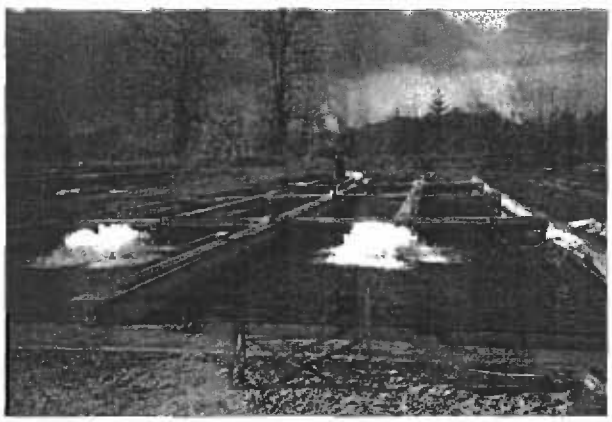




◄ *Rainbow trout is the main cultured fish species in the EEC. Adult (upper) and parr (lower).*

Production of rainbow trout farming has grown steadily from the beginning of the 70's. The EEC production in 1989 amounted to 160 560 t and represented around 66 % of the world's production (approximately 240.000 MT/year), and realised a turnover of about 425 mecus (ex-farm prices).

Trout is marketed in a variety of different forms ranging from alive and fresh fish to prepared trout dishes.



▲ *Oxygenation in used to improve the water quality and hence to increase the yields of intensive trout farming (Photo Serge Lucas).*

4. Prospects for future development

The trout industry is in a mature stage. Limitations involve the lack of sites, the market prospects and increasing concern about the environment. For the latter, new regulations relating to water abstraction and effluent discharge, and control over feed conversion will represent severe constraints to the development of the industry.

In order to continue succeeding, this industry has to maintain profitability and develop good marketing strategies. Overall little growth is expected, but trout will remain an important aquaculture product in the EEC.

EURAQUA '92

Edited by the Commission of the European Communities – Directorate General for Fisheries

Main eel farming areas in the EEC.

EEL

Anguilla anguilla (Linnaeus)

English	: Eel	German	: Aal
French	: Anguille	Greek	: Chéli
Dutch	: Paling	Spanish	: Anguila
Danish	: Ål	Portuguese	: Enguia
Italian	: Anguilla		

1. Biology, distribution

Carnivorous fish (mainly invertebrates) belonging to the *Anguillidae* family. Catadromous migrator, unique breeding area in the Sargasso Sea. The larvae (leptocephalus) are passively transported through the Atlantic Ocean.

Juveniles enter fresh and brackish watercourses, where they grow to mature phase. Distribution : all European and African coasts to approximately 25° N.

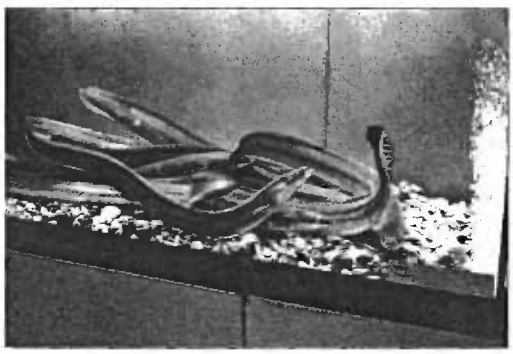
2. Eel farming

There are two species of eel farmed in large quantities in the world : the Japanese eel *Anguilla japonica* whose culture production is concentrated in Asian countries (Japan, Taiwan, China), and the European eel *Anguilla anguilla* whose farming is practised in Europe. The total world production (fisheries plus farming) of eels is estimated at 110,000 MT/year.

The farming techniques of *Anguilla anguilla* can be grouped in 3 main categories : extensive, intensive and recirculating systems.

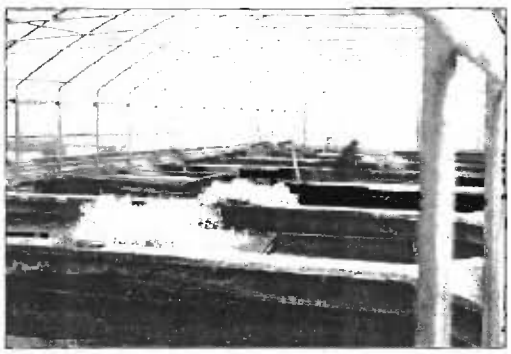
2.1. Extensive farming : the most ancient technique, it exploits the natural tendency of the fish to enter brackish lagoons to grow. After (on average) 5-7 years the mature fish leaves the lagoon for the reproductive migration and is captured by fixed devices ("lavoriero", "bordigue"). Fishing with mobile gear is also fairly common in many lagoons.

This technique, once largely employed in Southern Europe, is gradually reducing in importance due to the increased exploitation costs which, linked with the poor yield per surface unit, makes it insufficiently viable.

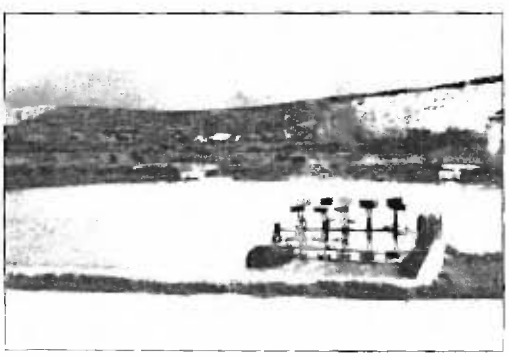


▲ *Photo : E. Gelosi – Stabilimento Ittiogenico di Roma).*

▼ *Extensive farming : an Italian "valle". (Photo A. Piccioli).*



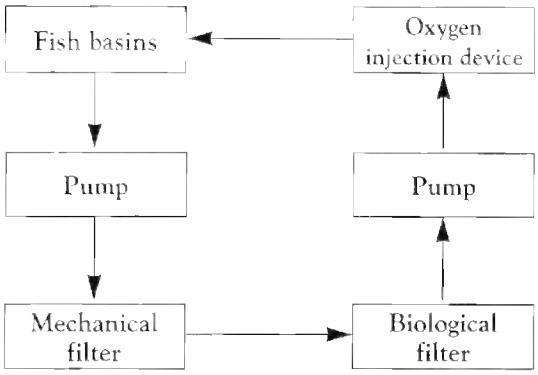
◄ *Intensive farming : concrete basins. (Photo : E. Gelosi – Stabilimento Ittiogenico di Roma.)*



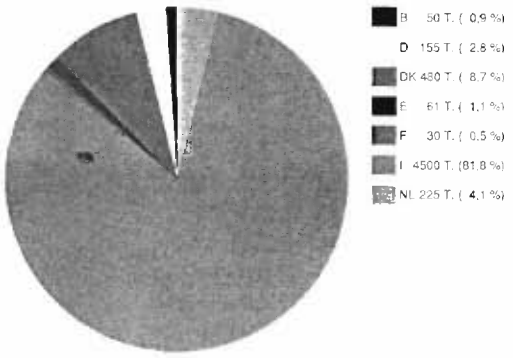
◄ *Intensive farming : earth basin. (Photo : E. Gelosi – Stabilimento Ittiogenico di Roma.)*

2.2. Intensive farming : this technique, imported from Japan, is based on the catch of wild glass-eels or elvers and their on-growing development in concrete or earth basins. The size of the basins varies largely but rarely exceeds 2 000 m^2, water intake (mainly fresh) is sometimes added with liquid oxygen; fish density can reach (in very good conditions and with oxygen addition) 30 kg/m^2. The availability of sufficiently warm water is the corner stone of this technique. This industry is particulary developed in Italy. It is performing relatively well, however it has to face some limiting factors : insufficient recruitment of elvers, excessive cost of the weaned glass-eel, pathology, tendency of the eel to mature as a male (which stops growing at a lower size) in high density farming conditions.

2.3. Recirculation systems : indoor recirculated system began in the early 1980's in Northern Europe, and is currently developed mainly in Denmark, Germany and the Netherlands, where approximately 85 farms are operational. The basic idea is that heating of the water to optimum growth temperature is economically feasible and water quality parameters and diseases can be controlled. Fish basins are small (rarely exceed 25 m^2) and fish densities very high (from 30 to 90 kg/m^2, with an average of 50 kg/m^2). Apart from some Danish farms producing fingerlings, these units have shown poor economic viability so far. It is indeed true that due to the short time of operation a great number of these farms have not reached the stage of full production, so a definitive conclusion cannot be drawn. The main reasons for poor economic performance are: over-estimated growth rates, lack of knowledge concerning optimal water flows and treatment efficiency of filters, lack of management capacities and farmers skills.



Simplified scheme of recirculation cycle



Eel farming production in the EEC – tonnes – 1989

3. Production and market

European Community farms produce approximately 5,500 MT of marketable eel (1989) which represents 32 % of the estimated world landings of *Anguilla anguilla* (17,000 MT). The bulk of farmed production is represented by extensive and intensive units in Italy.

Eel trade in Europe is a very specialized business, because of the highly specific requirements of each market regarding product quality and size.

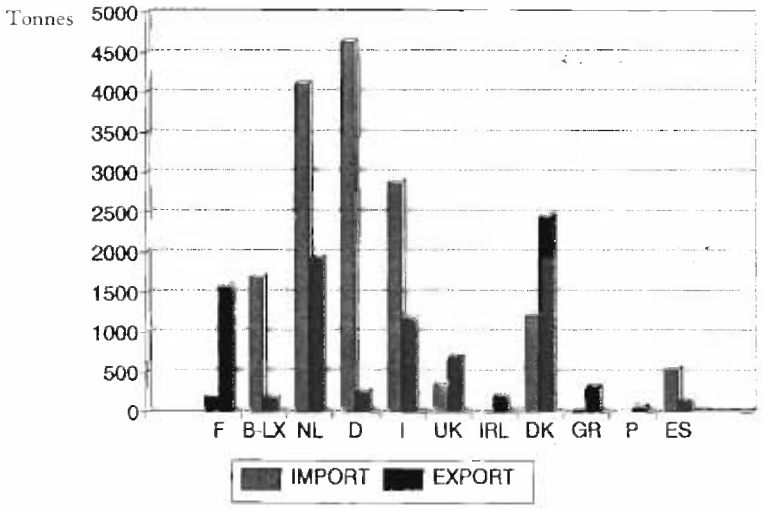
Fish of larger size (300-500 g) find a better price (approximately 20 % higher) than the smaller ones (150 g). In Italy demand is focused on large sizes (300-400 g) during the Christmas period, in other periods smaller sizes (200-250 g) are preferred and consumed marinated. In the German market about 90 % of the demand is for smoked eels, and traditionally large eels (400-800 g) are utilized for smoking. Due to the limited supply, smaller sizes (200-250 g) are now also utilized for smoking. The Dutch and Belgian eel consuming market are focused on small eels (100-200 g). The French market is limited to about 1,500 MT/year, both small and large eels are consumed. Generally speaking, in the last ten years the eel market was rather stable in Europe.

4. Development perspectives

There is no evident perspective of a significant increase of eel consumption in Europe, at least in the short term. However, the decreasing quantity of wild eel catches and the little chance of an increase in Asian farmed eel exports to Europe leaves the European farmers with the opportunity of further developing their production to a certain extent.

Some bottle-necks must be solved: the insufficient elver supply, the excessive cost of weaned glass-eels, some pathology problems, the technical and managerial weaknesses of recirculating systems, the competition with other economic interests for the use of water resources and land sites.

European Community eel trade – 1989



Edited by the Commission of the European Communities – Directorate General for Fisheries

SEABASS AND SEABREAM

Main seabass and seabream farming areas in the EEC.

Dicentrarchus labrax (Linnaeus)

English	:	European seabass
French	:	Bar
Dutch	:	Zeebaars
Danish	:	Almindelig bars
Italian	:	Spigola
German	:	Wolfsbarsch
Greek	:	Lavráki
Spanish	:	Lubina
Portuguese	:	Robalo

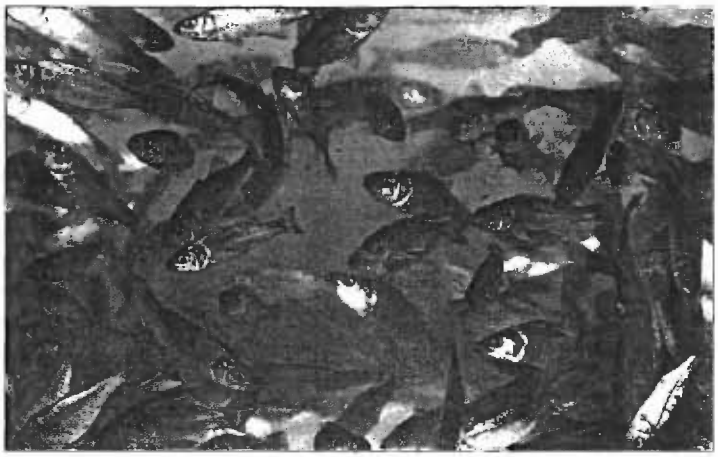
Sparus aurata Linnaeus

English	:	Gilt-head seabream
French	:	Dorade royale
Dutch	:	Goudbrasem
Danish	:	Guldbrasen
Italian	:	Orata
German	:	Goldbrassen
Greek	:	Tsipoúra
Spanish	:	Dorada
Portuguese	:	Dourada

1. Biological elements and natural conditions

Carnivorous fish belonging to the *Serranidae* (seabass) and to the *Sparidae* (seabream) families extend geographically from the South of the North Sea to the Mediterranean.

They are inshore fish that prefer to be near rocky zones, in estuaries and lagoons.



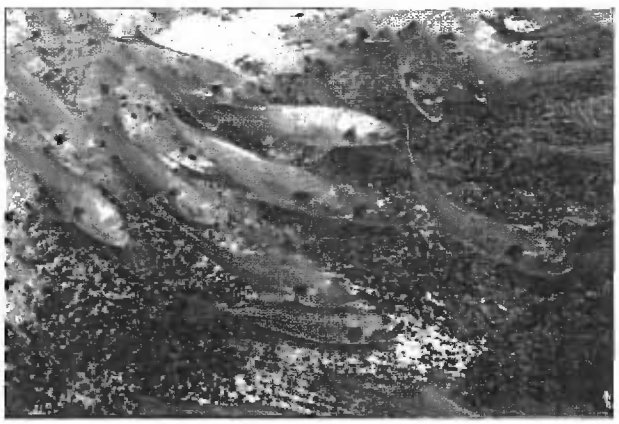
Young seabasses (Photo Serge Lucas). ►

2. Farming techniques

Three types of rearing are used at the present time :

2.1. Extensive rearing :

It is practised in Italy (valliculture), in Greece (lagoons), in France (development in marshes) and in Portugal (aquaculture development of the old salt marshes). This farming type depends on the migratory behaviour of the species in question which enter the lagoon from their early stages in order to grow and then leave for reproduction purposes. Harvesting is carried out at the limits of the lagoon with the open sea by means of traps. Production is subject to the natural resource that works its way into the lagoon the capacity of which is determined by its trophic level.



▲ *Seabreams (Photo Serge Lucas).*

2.2. Semi-extensive rearing

Semi-extensive farming of seabass and seabream is based on a better management of the rearing sites thanks to the introduction of wintering ditches that act as a refuge for the fish in case of the excessive cooling-down of surface water and where food leftover is supplied to improve growth (converted salt marshes in Portugal, improved "valliculture" in Italy).

2.3. Intensive rearing

Aims to produce seabass and seabream in high stocking density.

It includes :

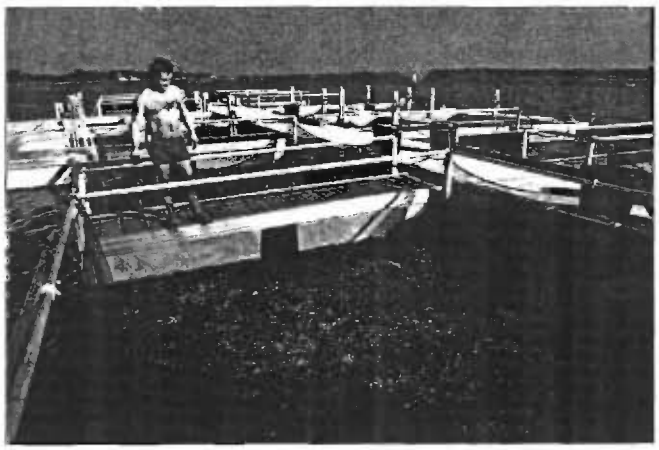
— Hatcheries : Installations/equipment for egg-laying, hatching and first stages development up to 2 grs.

▼ *Nursery (Photo A. Piccioli).*

— Nurseries : Installations/equipment of next development stages (2 grs up to 5 grs or 20 grs).
— Ongrowing : which can either be in :

- earth ponds
- off-shore cages

where the fish can reach a commercial size of 300-500 grs. Earth ponds are mostly found in Italy, Spain and Portugal. Off-shore cages are the most recent method used in the Mediterranean to develop these farming methods (Greece and France).



▲ *Off-shore cages for ongrowing (Photo Serge Lucas).*

▲ *Land-based basins for ongrowing (Photo A. Piccioli).*

Seabass and seabream production: volume and value per Member State in 1989.

Country	Volume	Value
Italy	1 900 t	35.20 mecus
Greece	550 t*	6.35 mecus
Spain	368 t*	3.90 mecus
France	239 t*	3.80 mecus
Portugal	230 t	2.55 mecus
Total	3 287 t	51.80 mecus

* This covers only the production from intensive farming systems.

3. Seabass and seabream farming in the EEC

"Valliculture", lagoons, salt marshes production, as well as intensive production yielded 3 300 tonnes in 1989.

This corresponds to a turnover of 51.8 mecus.

Italy, Greece, France and Spain are the major producers and although this production represents only 1.5 % of the fish production in terms of volume in the EEC, it amounts to 6.5 % in terms of turnover.

4. Perspectives of development

Community market for seabass and seabream is currently dominated by fishing, relatively small and limited to some countries. The market is performing well but special attention must be paid to all further development of farming, as a production overload is possible because of the increase in the rate of production due to the many farms in construction. Imports from non-EEC Mediterranean countries are also increasing.

One might hope to see the same phenomenon happen for bass and bream as it did for salmon, that is a more important increase of the supply than of the demand due to a better knowledge of the product. Thus, a general reduction in prices is expected.

Therefore, it's urgent for producers to enforce all possible measures open to them in order to contain and reduce production costs.

The preservation of suitable sites for the development of this type of intensive rearing represents capital for the future of seabass and seabream aquaculture.

Effectively, it is necessary to assure the good quality of the available sites so that farming could be possible.

Furthermore, special attention must be paid to avoid any polluting effect of the farms on their own surroundings.

EUROPA '92

Edited by the Commission of the European Communities - Directorate General for Fisheries.

Main carp and pond fish farming in the EEC.

CARPCULTURE AND POND CULTURE

CARP

Cyprinus carpio Linnaeus

English	: Carp	German	: Karpfen
French	: Carpe	Greek	: Kyprínos
Dutch	: Karper	Spanish	: Carpa
Danish	: Karpe	Portuguese	: Carpa
Italian	: Carpa		

A) CARPCULTURE

1. Biological elements and natural conditions

Carp belongs to the cyprinids family and is found extensively throughout the world in ponds in combination with other species (roach, tench and pike).

Carp as a wild and herbivorous animal can be easily reared for food and ornemental purposes (carp koi).

2. Farming techniques

Carp farming is carried out in ponds where production is maintained essentially from renewable resources from the pond's aquatic ecosystem.

One can, however, distinguish several forms of rearing :

2.1. Extensive carpculture

This type of farming dates back to the Middle Ages in Europe and to ancient China where it represents a source of relatively important animal protein.

▲ *General view of an extensive pond – Poitevin marshes – France (Photo Serge Lucas).*

The rearing technique, is based on the optimisation of the pond's trophic chain in order to achieve the maximum fish yield. To achieve this effect, it's necessary to fertilize and oxygenate the environment, to select short trophic chains and eliminate possible competitors.

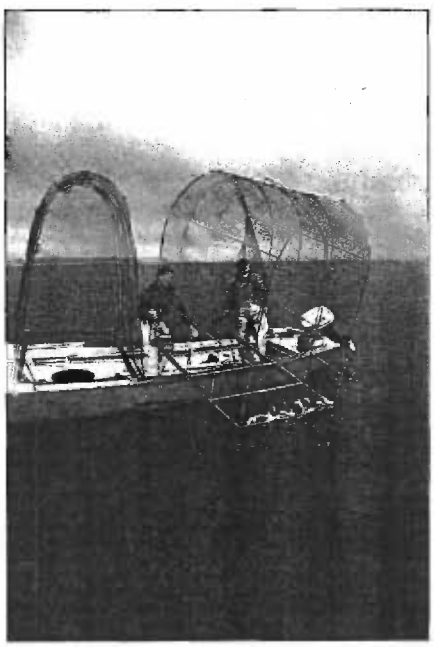
Juvenile production is carried out in ponds called "pose" where the adult spawning process takes place and these are subject to careful attention and to a rich food supply.

2.2. Semi-intensive or intensive carpculture

This is characterized by a substancial food supply allowing a high farming density and a resort to incubation techniques, hatching and larval rearing in controlled facilities.

◄ *"Self-service" (or feeder) for "ad libitum" feeding in an intensive carp rearing in Germany close to Bremen. (Photo J. Wessel).*

Immersion of cages for perches in the Leman lake, France (Photo Serge Lucas). ►



Different types of ponds are used for the young stages of rearing and then for on-growing. Heated water is used in certain high density farming with permanent oxygenation in which carp often represents a secondary species with the eel (water recycled rearing).

3. Importance of production in the EEC

World production of carp is estimated to be 4 350 000 tonnes. China holds first place in this production. The European Community represents only a small part of this total with an estimated production in 1989 of 27 000 tonnes approximately with a turnover of 38,9 mecus.

State of volume and turnover in the EEC in 1989.

Country	Volume	Turnover
Germany*	21,300 t	31.0 mecus
France	4,000 t	5.1 mecus
Belgium	600 t	1.4 mecus
Italy	500 t	0.6 mecus
Greece	350 t	0.7 mecus
Netherlands	100 t	0.1 mecus
United Kingdom	20 t	–
Total	26,870 t	38.9 mecus

* Production of GDR and FRG is included.

4. Development perspectives

The limits on developing carp farming seems to be a matter of market demand at present.

Furthermore, production prices on the European market suffer from competition with of the Eastern European countries which naturally leads Community producers to reflect on intensifying production in rearing systems where water management takes on a new importance.

It also seems necessary to develop new forms of consumption of fillet of carp products in order to develop market outlets.

Finally, the use of carpculture for non-food purposes, like restocking for recreational fishing or for ecological purposes using carp as a biological filtre are, ever on a small scale, quite possible.

◀ *Fishing in a pond with a net in Martinique, France (Photo Serge Lucas).*

B) POND CULTURE

1. General points

Aquaculture in ponds is traditionally associated with carpculture. It's an extensive form of rearing for "fresh water" species such as tench, roach and pike and of course for carp which makes up the main species.

2. Farming techniques

The ponds are managed in an extensive way. The fish-rearing stocks cohabitate in balance with the environment. Fishing takes place once or several times a year by net.

Intensification efforts can be reached by the selection of main species, management of an hydraulic system, maintaining the pond walls and the draining of ponds, food supply...

▼ *Flood-gate regulating the water level of a rearing pond in the Gironde region, France (Photo Serge Lucas).*

3. Rate of production

The production figures for this type of white fish are very difficult to obtain. EEC production is estimated to 36.700 tonnes approximately, and carp represents 73% of this volume.

France alone appears to produce roughly 8 000 tonnes the half of which is carp. Production is for restocking or human consumption.

4. Development perspectives of the sector

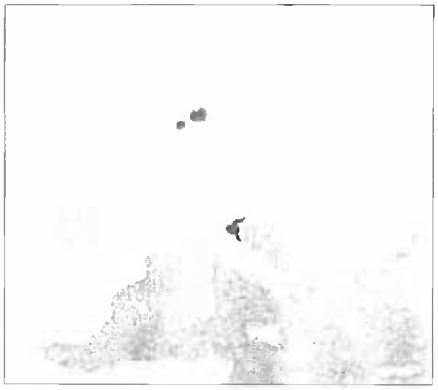
Cultivation which takes place in the framework of developing rural areas with many ponds such as "la Sologne" and "les Dombes" in France, is moving towards intensive methods with the aim of producing fillets of white fish for a high demanding European market.

Therefore, pond culture can contribute to the diversifying efforts of agricultural projects recommended by the new Common Agricultural Policy.

The environmental constraints relative to this type of farming are low, however one can point out depredation carried out on ponds by fisheating birds (heron, cormorant).

Edited by the Commission of the European Communities – Directorate General for Fisheries.

CATFISH



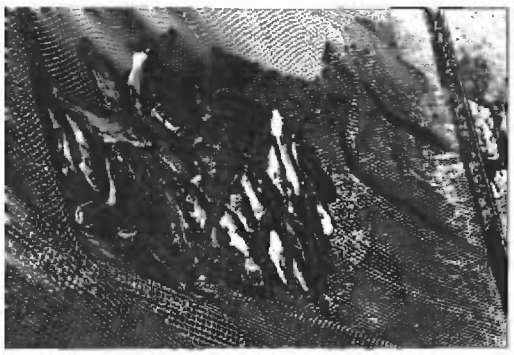
Main catfish rearing areas in the EEC.

Ictalurus melas (Rafinesque)

Anglais	:	Black bullhead
Français	:	Poisson chat d'Amérique
Néerlandais	:	Zwarte dwergmeerval
Danois	:	Sort dværgmalle
Italien	:	Pesce gatto
Allemand	:	Katzenwels
Grec	:	Gatópsaro
Espagnol	:	Pez gato
Portugais	:	Peixe gato americano

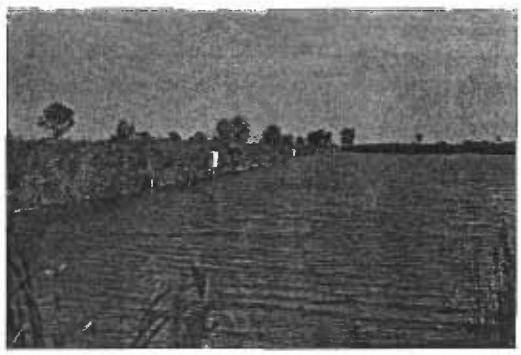
Ictalurus punctatus Rafinesque

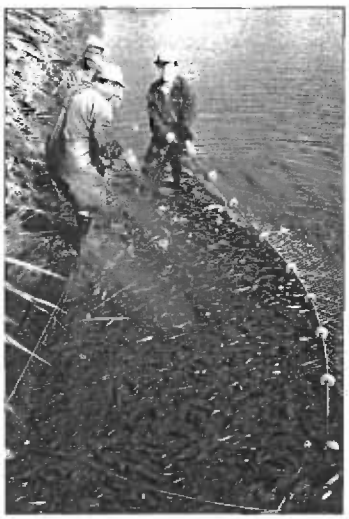
Anglais	:	Channel catfish
Français	:	Poisson chat tacheté
Néerlandais	:	« Channel catfish »
Danois	:	Plettet dværgmalle
Italien	:	Pesce gatto americano
Allemand	:	Amerikanischer Katzenwels
Grec	:	Gatópsaro
Espagnol	:	Pez gato
Portugais	:	Peixe gato americano



◀ *(Photo P. Melotti)*

Basin ▶
(Photo P. Melotti)





▲ *Catch of marketable adults (Photo P. Melotti)*

Following the development of this industry in the USA, in the early 1970's catfish farming was introduced in Europe. There are two species dominating the European scene : the black bullhead *Ictalurus melas* and the channel catfish *Ictalurus punctatus* which was introduced in Europe in the 1980's.

The black bullhead is a sturdy warmwater species which is usually farmed in earth basins in semi-intensive culture. It is an easy-to-farm species, the requests for water quality and flow are rather modest, the spawning occurs naturally in the ongrowing ponds, the growth cycle (from birth to a marketable size of 150 g) usually does not last for more than two years. The human consumption is only locally developed in Europe, but in some countries this fish is also used for game fish purposes.

The channel catfish farming had a fast development in the 1970's in the USA, where it is currently one of the most important species for farming. It is considered a very good game fish and it is also very popular for human consumption, mainly filleted. Commercial size and growth rate are remarkably higher than the black bullhead : two years specimens easily attain 500 g. This industry is slowly developing in Europe, replacing the black bullhead farming.

Other catfish species *(Ictalurus nebulosus, Clarias spp.)* are occasionally farmed, more or less in pilot scale. Probably due to lack of knowledge from the consumer and the transformation industry, and scarce promotion campaigns (which made the success of channel catfish possible in the USA) these species are poorly farmed and consumed in Europe.

Recent and homogeneous data on production and market are not available, but the total EEC farm production can be estimated to be no more than 3 000 MT/year, all species mixed. The main producers are Italy and the Netherlands.

Edited by the Commission of the European Communities – Directorate General for Fisheries.

CLAM FARMING

Main clam rearing areas in the EEC.

Ruditapes decussatus (Linnaeus)

Anglais	:	Grooved carpet shell
Français	:	Palourde
Néerlandais	:	Tapijtschelp
Italien	:	Vongola verace
Allemand	:	Teppichmuschel
Grec	:	Achiváda
Espagnol	:	Almeja fina
Portugais	:	Amêijoa boa

Ruditapes philippinarum (Adams & Reeve)

Anglais	:	Japanese carpet shell
Français	:	Palourde japonaise
Néerlandais	:	Tapijtschelp
Italien	:	Vongola verace asiatica
Allemand	:	Teppichmuschel
Grec	:	Achiváda
Espagnol	:	Almeja japonesa
Portugais	:	Amêijoa japõnesa

The Japanese carpet shell *Ruditapes philippinarum* (also known as Manila clam) is replacing the European species *Ruditapes decussatus* for farming purposes all over Europe, due to its faster growth rate and higher resistance to pathologies, temperature and salinity variations. Both species are eurythermic and euryalin, living in mixed sand-mud bottoms in coastal areas and lagoons. *Ruditapes decussatus* is distributed in coastal areas of the Mediterranean and Eastern Atlantic from Norway to Congo; the original distribution of *Ruditapes philippinarum* covered a vaste area from Pakistan to Kuril Islands, comprising Japan, Philippines and Indonesia, but due to farming this species is now widely spread throughout the world. In Japan the aquaculture production of this species largely exceeds the wild catches. The success of *R. philippinarum* is also due to the possibility of artificial breeding : in the European Community, hatcheries are located in United Kingdom, Spain and France.

▲ *(Photo A. Piccioli).*

The farming of this species is based on artificial reproduction, nursery phase in tanks, little ponds or boxes, and release of T6-T8 juveniles in controlled areas (lagoons, salt-pans, large ponds or "parks" in the open sea) often with different sorts of protections (the commonest system is to cover the area where the clams are settled with nets of little mesh size, to avoid predation and escapements).

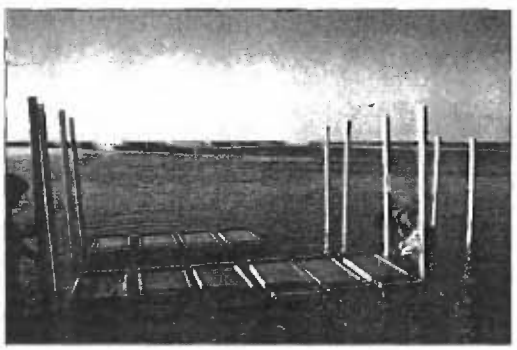
An activity of culture based fishery of this species is also developing: the natural reproduction of animals originally released for farming is creating wild populations in areas that were previously non-producing, which are being exploited with traditional fishing methods. This means that there is a growing concern over competition with the autoctonous species and the risk of diseases being spread must also be taken into account. A rapid application from the Member States of the recently published Council Directive concerning the animal health conditions governing the placing on the market of aquaculture animals and products (91/67/EEC) is desirable.

Clam farming is rapidly developing all over Southern Europe: total production of farmed clams (both species *R. philippinarum* and *R. decussatus*) attained in 1989, 19 500 MT. The main producers are Portugal, Italy and Spain.

Perspectives of development are very good, because there is still a demand for these species and the wild catches are decreasing. Availability of suitable sites is, however, a cause for concern as sanitary and environmental controls are necessary.

▲ *Nursery phase in boxes (Photo Aquamar Spa).*

▼ *Placing the nursery boxes (Photo Aquamar Spa).*



Preparing the ongrowing parks (Photo Aquamar Spa). ►

THE TURBOT

Main turbot rearing areas in the EEC.

Psetta maxima (Linnaeus)

English	: Turbot	German	: Steinbutt
French	: Turbot	Greek	: Kalkáni
Netherlands	: Tarbot	Spanish	: Rodaballo
Danish	: Pighvar	Portuguese	: Pregado
Italian	: Rombo chiodato		

1. Natural conditions and distribution

Turbot is a flatfish fished in the North Atlantic Ocean and the Mediterranean Sea with the scientific name *Psetta maxima*. It is considered a premium flatfish which is marketed at high prices.

Wild supplies which are erratic, are estimated to be below 10,000 t/year and come mainly from Denmark.

The life cycle from egg to marketable size can be achieved in approximately 2 years at optimum water quality. Due to the static living habit of the flatfish on the seabed, high stocking densities can be achieved in artificial culture conditions.

These advantageous characteristics makes the turbot an ideal candidate for rearing.

◀ *The juveniles have already achieved the adult features to adapt to life on the seabed. (Photo France Turbot).*

2. Farming cycle

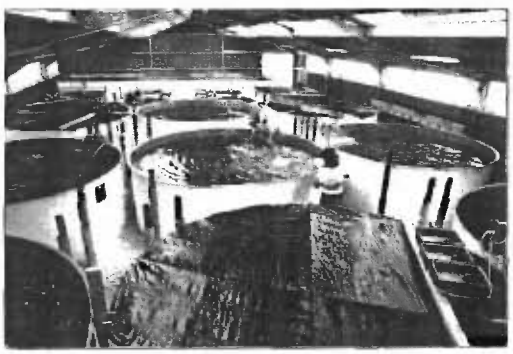
For the farming of turbot, land based systems with pumped seawater are used.

Manipulation of environmental factors such as photoperiod and temperature induce the maturation process of the broodstock. This allows an egg supply distributed throughout the year. The fertilized eggs are incubated in gentle aerated water. Larval rearing is done in indoor tanks, where live feed has to be supplied. When they are 10-12 days old, the larvae transform into fry. Both eyes "migrate" to the top of the fish in order to adapt to life on the seabed.

After weaning to semi-moist diets, the fry or juvenile is transfered outside to larger ongrowing tanks.

Here, the fish has to be protected from excessive sunlight.

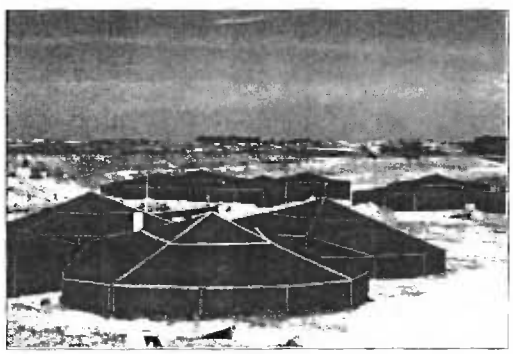
The fish reach a weight of around 2 kg after about 2 years, and are ready for the market.



▲ *Hatchery (Photo Serge Lucas).*

▼ *Nursery for the production of juveniles (Photo Serge Lucas).*

Ongrowing tanks protected from excessive sunlight (Photo Serge Lucas). ▶



3. Turbot farming in the EEC

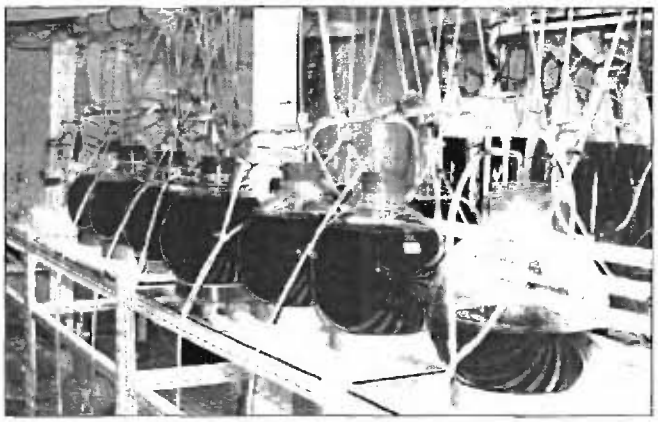
The infant turbot farming industry is developing fast in Spain and France. The actual production of 280 t is concentrated in the Spanish Galicia region.

United-Kingdom and Germany are producers of juveniles which are exported to other countries for ongrowing. France is also a net exporter of juveniles.

The turnover of farmed turbot in the EEC arises to 3,44 mecus.

Turbot production in 1989:

Country	Volume	Value
Spain	270 t	3,34 mecus
France	10 t	0,10 mecus
Total	280 t	3,44 mecus



▲ *Production of high quality live feed is one of the key factors to obtain healthy juveniles for ongrowing (Photo Serge Lucas).*

4. Prospects for future development

There are no major constraints for the development of turbot farming. Challenges of this developing industry comprehend:

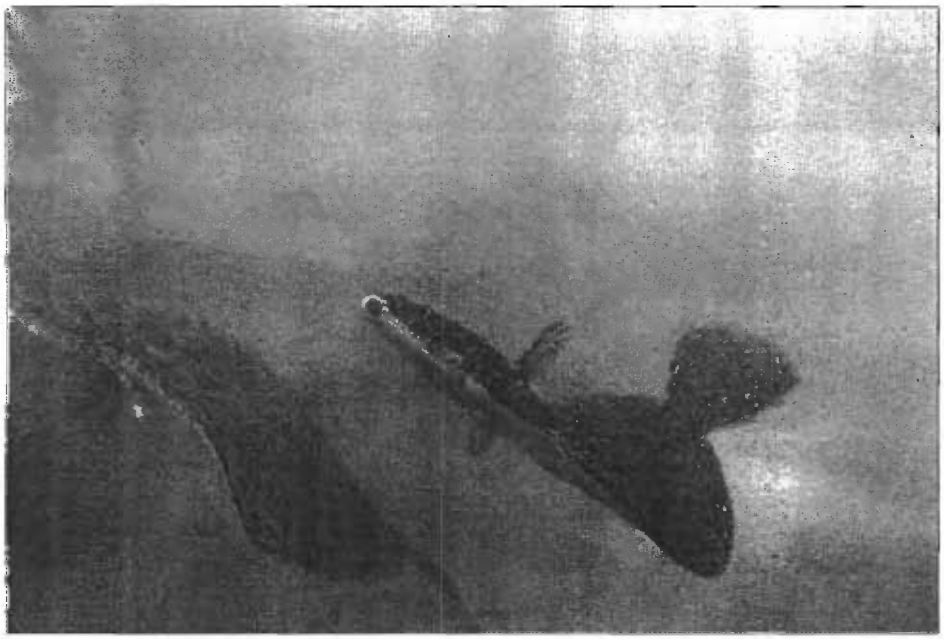
— improvement of live and artificial diets,

— achievement of higher yields of pigmented and non-deformed juveniles; and, in general terms,

— optimization of the production process.

Large increases of production are forecasted in Spain and France.

Marketing strategies have to be developed in order to maintain good market conditions in line with the rapidly increasing production.



▲ *Adult turbot reaches marketable size around 2 kg (Photo Serge Lucas).*

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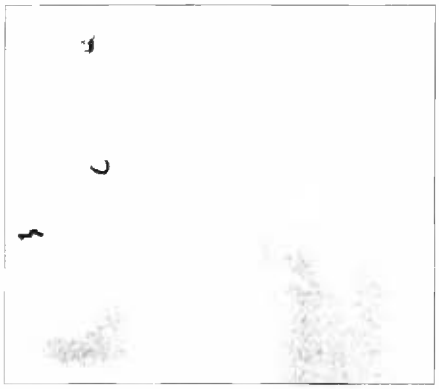
THE KING SCALLOP



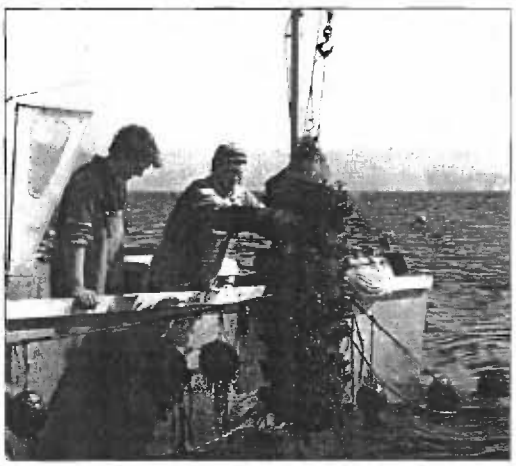
Main scallop farming areas in the EEC.

Pecten maximus (Linnaeus)

English	: King scallop	German	: Pilger-Muscheln
French	: Coquille Saint-Jacques	Greek	: Cténi
Dutch	: St. Jacobsschelp	Spanish	: Vieira
Danish	: Kammuslinger	Portuguese	: Vieira
Italian	: Conchiglia di San Giacomo		

The King scallop *Pecten maximus* is a mollusc living in groups on sandy seabeds from 5 m tot 50 m depth and is found in Europe from the North Sea to Portugal.

Close-up of a King scallop Pecten maximus; restocking the Saint-Brieuc Bay, France (Photo Serge Lucas). ►



▲ *Raising a japanese lantern for farming King scallops in the area around the Isle of Scalpay in Scotland. (Photo J.A. Walford).*

The King scallop is normally fished, but can be also cultivated through methods imported from Japan.

Started in Japan during the fiftees, the cultivation of King scallop is based upon spat collection on specific material chosen for this purpose.

Then the young shells are distributed on seabeds for fishing at a marketable size, or put in suspended cages called lantern nets.

Anticipating poor spat collections in natural conditions, the development of hatcheries and nurseries appeared to be a worthy cause but unresolved problems still remain.

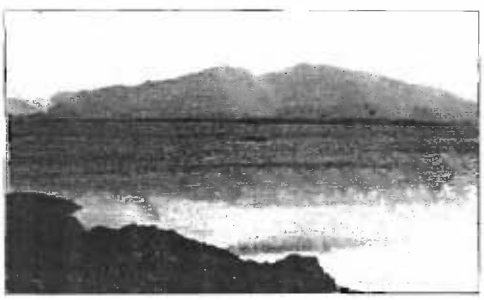
Despite being an important marine resource for certain fishing zones in the EEC, King scallop cultivation is still in its early stages.

▲ *Selection and preparation of shipment of scallops in the bay of Saint Brieuc, France (Photo Serge Lucas).*

This culture, however, is developing in Spain where production is estimated to reach 150 tonnes, in Ireland as well as in West Scotland where the production cycles, based on japanese techniques, are just starting. In France, the efforts untertaken to increase production are focused more on spat collection for re-seeding the natural seabed for fishing purposes.

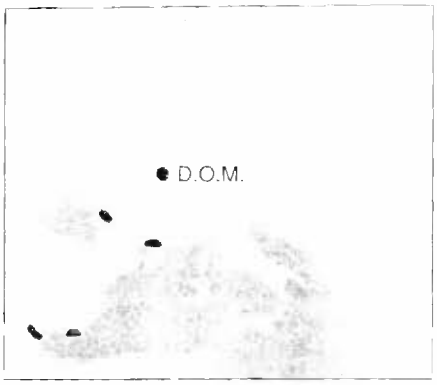
The King scallop market is supplied by products imported from the Pacific Ocean as well as by European production.

Aquaculture must therefore produce at costs that are competitive with fishing in order to develop. The environmental constraints for this type of extensive culture seem minor given their small scale as well as extensive nature. The availability of spat for each rearing cycle is still not guaranteed.



▲ *View of the farm site at the Isle of Scalpay in Scotland (Photo J.A. Walford).*

SHELLFISH CULTURE



Main rearing areas of caramote prawn and kuruma prawn in the EEC.

PRAWNS

Penaeus kerathurus (Forsskål)

English	:	Caramote prawn
French	:	Caramote
Dutch	:	Garnaal
Danish	:	Rejer
Italian	:	Mazzancolla
German	:	Geisel Garnelen
Greek	:	Gámberi
Spanish	:	Langostino
Portuguese	:	Camarão da praia

Penaeus japonicus Bate

English	:	Kuruma prawn
French	:	Crevette kuruma
Dutch	:	Garnaal
Danish	:	Rejer
Italian	:	Mazzancolla giapponese
German	:	Japanische Geisel Garnelen
Greek	:	Gámberi
Spanish	:	Langostino japonés
Portuguese	:	Camarão japonès

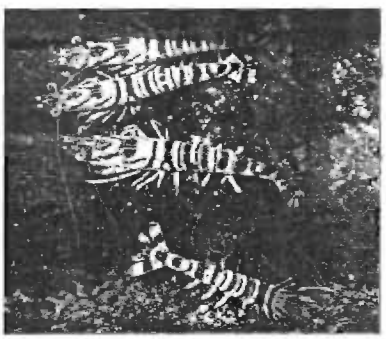
The penaeids family species represents the most typical type of shellfish farming in Europe.

The natural environment of these shrimps is the sandy bed of bays as well as river mouths. However, they are found in the open sea at times of reproduction.

The species *Penaeus japonicus* (Kuruma prawn, also called imperial shrimp) shows the most interesting characteristics for aquaculture. Of Indo-Pacific origin it immigrated into the Mediterranean through the Suez canal.

It offers : – a strong ecological tolerance;
– an important commercial value.

The particular resistance qualities of these species to the physico-chemical variations of the water quality have led certain researchers to run pilot projects concerning their development. It has also been shown that the biological characteristics of these shrimps allow an optimal development in a controlled environment (hatcheries, on-growing).

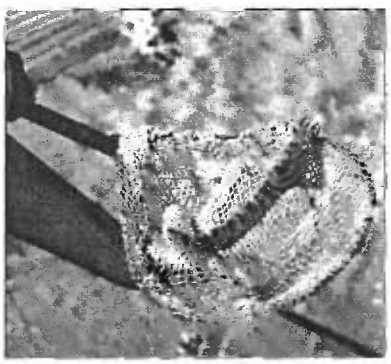


◄ *The imperial shrimp : Penaeus japonicus (Photo Serge Lucas).*

This is a fairly recent activity (1980) where production hardly exceeds 450 tonnes.

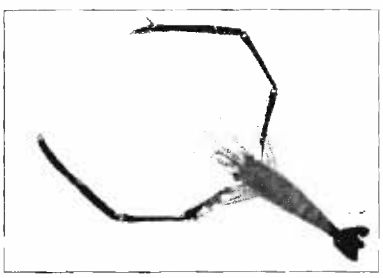
The principal producers are France and Spain. In Portugal, development of this type of rearing has only begun.

▼ *Penaeus japonicus (Photo Serge Lucas).*



In spite of a very important shellfish market in Europe, European farmers have not had a great success either in the restocking of lobster process in France, of shrimp in Greece (*P. kerathurus*) or even in intensive rearings. The actual solution which consists in acclimatizing *Penaeus japonicus* to semi-extensive rearing in marshes or "salines" encounters enormous difficulties for post-larval survival due to unresolved feeding problems in our latitudes.

Strong competition coming from South-East Asian and Latin American producers makes the programming of new axes of research and development of these species difficult whose rearing in Europe at present appears having to be delayed.



◄ *Macrobrachium rosenbergii (Photo Serge Lucas).*

Another shellfish *Macrobrachium rosenbergii* is also farmed. This particular rearing has been developed by the french overseas departments (Guiana, Martinique, Reunion) because of natural conditions characteristics of these tropical or subtropical islands. Nevertheless, the economic results have been poor for the moment. Overall production from these farms is estimated be around 50 tonnes in 1989.

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